

Health Consultation

GLOVER SITE

aka

TENNESSEE PRODUCTS

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CHATTANOOGA, HAMILTON COUNTY, TENNESSEE

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
The Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
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Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Background and Statement of Issues

In recent years, the City of Chattanooga has experienced urban renewal following many years as an industrial center. The Trust for Public Land in Chattanooga has developed a plan for a series of interconnected greenways. Their plan includes a hiking/exercise path along Chattanooga Creek (Figure 1) (TPL 2002). With this greenway development in mind, the Tennessee Department of Health (TDH), Division of Environmental Epidemiology (EEP), has been involved with meetings, discussions, and planning with stakeholders. EEP was asked to review data and provide recommendations as to whether or not a greenway could safely be operated along Chattanooga Creek within an area called the Glover Site. The purpose of this health consultation is to document that review and the associated findings.

Environmental contamination in the Chattanooga Creek floodplain and how to clean it up has been an ongoing debate for more than three decades. Chattanooga Creek runs through several south Chattanooga neighborhoods as it flows northward for several miles into the Tennessee River. Much of the creek and its floodplain were polluted by past industrial activities. Many federal and state Superfund sites exist within the floodplain. In the floodplain, pollutants such as coal-tar, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and pesticides have been commonly reported (ATSDR 1994; EPA 1996, 2002). The United States Environmental Protection Agency (EPA) completed one phase of its planned cleanup in 1997-98 (EPA 2002).

The University of Tennessee at Chattanooga (UTC) received an environmental justice grant from the EPA to perform environmental sampling. UTC partnered with the citizen group Stop Toxic Pollution (STOP) to determine community concerns. UTC subcontracted with Tennessee Technological University in Cookeville (TTU) for laboratory analysis. After encouragement to investigate Chattanooga Creek pollution by local community members, the Glover Site was selected for their investigation. The Glover Site is large tract of land between 38th Street and Hamill Road (Figure 2). The area is bordered by both industrial and residential properties. Portions of Chattanooga Creek floodplain within the Glover Site were known to be polluted and considered high risk to the community (EPA 2002). Under permission of the property owner, environmental sampling was performed in fall 2003. Surface soils were collected and analyzed for polycyclic aromatic hydrocarbon (PAH) concentrations.

At first glance, the Glover Site is acres of woods. Chattanooga Creek, 10-15 ft wide, runs south to north through the site. The site has old EPA gravel haul roads that make excellent trails (Figure 3). The site is accessible to walkers but a gate (Figure 4) at Polk Street and E 42nd Street discourages vehicular traffic. In some places, small amounts of coal-tar can still be witnessed on the surface (Figure 5). Figure 6 depicts an old glass dump still present on the site. This glass is not recent; these bottles date back many decades to when they were waste from glass manufacturing in Chattanooga. Figures 7 and 8 are the west-to-east gravel haul road; this is a clear illustration of why the Glover Site is of interest for greenway development. Even during winter, good vegetative cover

is present. Flooding (and probably wetlands) can be seen in Figure 9. Figure 10, with tires, bottles, and plastic jugs, attempts to illustrate how commonplace garbage dumping is on the Glover Site.

Discussion

Environmental Sampling

The UTC and TTU performed the environmental sampling and analysis at the Glover Site (UTC 2003). Figure 11 shows the surface soil sampling locations. The locations, where soil samples were collected, follow roughly the site of the proposed greenway (Figure 1). The proposed greenway route is partially based on existing gravel haul roads that were used during the past cleanup of Chattanooga Creek and nearby coal-tar pits. The 3 inch depth soil samples were sent to the TTU EPA-certified lab for analysis. All samples were analyzed with an Enzyme-Linked Immunosorbent Assay (ELISA) method capable of determining total polycyclic aromatic hydrocarbon (PAH) concentration. Table 1 lists the total PAH soil data. The total PAH concentration of the 59 samples ranged from 18.8-523.0 milligrams per kilogram (mg/kg) with an arithmetic mean of 103.1 mg/kg. Figure 12 displays the total PAH data in roughly the north to south transect shown in Figure 11. Soil sampling locations 3, 10, 11, and 12 are labeled on the figure because they demonstrated the highest total PAH concentrations. These locations seem to follow the west-to-east gravel haul road. Residential homes are in close proximity to this road.

This ELISA method did not determine the concentrations of individual PAHs. Additional analysis was performed on some soil samples to determine the concentrations of individual PAHs known to cause adverse health effects. This process demonstrated the relative abundance of these PAHs in relation to total PAHs. Table 2 lists the data collected for individual PAHs. Toxicity Equivalency Factor (TEF) concentrations were also calculated (EPA 2004a) for each location where individual PAH concentrations were measured.

Figure 13 shows the concentration of benzo[a]pyrene (B[a]P) and seven other PAHs from the UTC dataset considered to be harmful to human health. It is interesting to note the similarity of the relative proportions of the various PAHs in each sample. This may indicate that the source of PAH pollution in the top 3 inches of soil is consistent at Glover Site. Figure 14 shows the same soil sampling locations with the ELISA method total PAH concentration graphed. It is interesting to note how well the individual PAH charts compare to the total PAH chart. This shows that using the quick, inexpensive ELISA test can provide useful information. At Glover Site, a relationship between B[a]P and total ELISA method PAH concentration was observed. Figure 15 plots the linear relationship. However, a relationship between PAH TEF and total ELISA PAH concentration was not found. Figure 15 illustrates that no apparent relationship between total PAH concentration and concentration of the most harmful PAHs measured in TEF can be concluded for the Glover Site from this data. In fact, some of the soil samples with high TEF concentrations had the lowest total PAH level. However, samples with the highest

concentrations of total PAHs did have corresponding high TEF concentrations as well. The 2003 UTC sampling had a range of 1.57 to 9.86 mg/kg B[a]P in surface soil. EPA performed surface soil sampling in 1996 when investigating coal-tar pits on the Glover Site. Measured B[a]P concentrations ranged from an estimated concentration of 0.220 to a concentration of 4.400 mg/kg (EPA 1996). The sampling locations in the EPA and UTC data sets are different, yet it is interesting that the recent data range for B[a]P is higher than past surface soil sampling and analysis.

PAH deposition following flooding events, which are common in the floodplain, has been suggested as a mechanism for PAH pollution in the Chattanooga Creek floodplain. This may explain why the relative proportion of individual PAHs was fairly consistent in soil samples. Regardless, flooding has the potential to distribute PAHs throughout the entire floodplain. That means that flooding has the potential to distribute PAHs across the proposed greenway system, too. Therefore, even after previous cleanup of Chattanooga Creek and nearby coal-tar deposits, PAH pollution is still a potential environmental public health concern.

Exposure Assessment

A tool commonly used during environmental public health investigations is a screening level. Screening levels are chemical concentrations based on toxicology below which no adverse health effects are predicted to occur. When a screening level concentration is exceeded, the term, chemical of concern (COC), is often applied. Chemicals of concern require closer investigation. When a chemical of concern is identified, it does not immediately indicate that people would be expected to develop adverse health effects. It does mean that the exposure scenario, including exposure potential, dose, duration, and frequency, needs to be thoughtfully considered.

People have to come into physical contact with the PAH-contaminated soils and be exposed to the contamination for adverse health effects to occur. In order for people to come into contact with the PAHs in the environment, there must be a *completed exposure pathway*. A completed exposure pathway consists of five main parts including:

1. a source of PAHs in the environment;
2. a means for the PAHs to migrate from its source to the soil;
3. a place where people come in to contact with the PAHs;
4. a pathway (route) by which people come into contact with the PAHs such as touching or breathing; and,
5. people who could potentially be exposed (receptor population).

Exposure pathways can also be characterized as to when the exposure occurred – in the past, in the present, or in the future.

Physical contact with the PAHs in the environment by itself does not necessarily mean that a person would develop adverse health effects. The PAH's ability to affect public health is also controlled by a number of other factors, including:

- How much PAH a person is exposed to (dose)
- How long a person is exposed to the PAH (duration)
- How often a person is exposed to the PAH (frequency)
- The resident's age
- The resident's diet and nutritional habits

During the site visit, it was obvious that local residents traverse this area via automobiles, bikes, and by walking. No signs or real barriers are present to inhibit entrance into and use of the site. People living in homes adjacent to the site have easy access to the site. It is obvious that people trespass on the Glover Site; dumping appears to be commonplace. Physical hazards are obvious; broken glass and debris are dumped and scattered throughout the area.

Chemical hazards include the dark-colored seeps of PAHs located at the surface throughout the area. In addition, numerous puddles with an oily sheen are present. Data indicate elevated levels of PAHs in surface soils over a large portion of the Glover Site. The residents have indicated that children frequently play in this area. Children playing in the floodplain soil or creek sediment are likely the receptors in an exposure scenario. PAHs often adsorb onto other solid particles such as dirt. The completed exposure pathways that could transfer PAHs into humans, if the Glover Site were to be used as a greenway, would be dermal contact, incidental soil ingestion, and soil/particulate inhalation.

Most of the Glover Site is well-vegetated. Vegetative cover is an effective barrier in limiting exposure to contaminated soils. Incidental ingestion of soil is not expected to be a major pathway of exposure since the site is well vegetated. Furthermore, incidental ingestion of tar-like material is doubtful. Inhalation of PAHs is not believed to be a major pathway of exposure at Glover Site. The tarry soil is located on or below ground surface, whereas the breathing zone is several feet above ground surface. Over an area of this size, any PAHs that volatilize into the air are likely to be diluted, wind-mixed, and not detectable. Dermal contact with PAHs is not expected to occur on a regular basis. It is assumed that people go into the wooded Glover Site for at most a few hours each week. Overall, the estimated exposure duration and frequency are small. Plus, most people wear clothes and shoes, providing a simple, efficient barrier to dermal exposure.

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons, commonly called PAHs, are a group of chemicals derived following the incomplete combustion of organic materials such as coal, oil, gas, wood, garbage, tobacco or meat. PAHs usually are found as complex mixtures of chemicals rather than just as individual chemicals. PAHs occur naturally or can be manufactured. More than 100 types of PAHs are known to exist throughout the environment, including in air, water, and soil.

Several PAHs, including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and

indeno[1,2,3-c,d]pyrene, have caused tumors in laboratory animals through inhalation, ingestion, and long-term dermal exposure. Studies of people show that some individuals exposed by breathing PAHs or skin contact for long periods to mixtures that contain PAHs and other compounds can also develop cancer (ATSDR 1995). Different PAHs have different toxic potencies. A Toxicity Equivalency Factor (TEF) methodology has been developed that combines the relative toxicities of individual PAHs in relation to benzo[a]pyrene, the PAH determined to be the most hazardous (EPA 2004a).

TEF concentrations ranged from 2.326-14.775 mg/kg with an arithmetic mean of 6.088 mg/kg. The concentration range for benzo[a]pyrene (B[a]P) was 1.57-9.86 mg/kg with an arithmetic mean of 3.99 mg/kg. These values exceed the ATSDR health screening Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk (CREG) of 0.1 ppm (mg/kg) (ATSDR 2004). These values also exceed the EPA Region 9 direct contact exposure pathways preliminary remediation goal (PRG) for B[a]P of 0.062 mg/kg for residential soil (EPA9 2002).

It is important to remember that although the Glover Site is near a residential neighborhood, it is not a residential property. The screening levels referenced are for people's lawns. If the levels of PAHs measured were in people's lawns where children and adults lived on a regular basis, then these chemicals could be of health concern. As the PAHs are mostly contained in soils on the Glover Site, where exposure scenarios have limited frequency and minimal duration, exceeding residential screening levels is acceptable. The PAHs at Glover Site do not appear to be a current public health issue. However, because the PAHs are chemicals of concern as defined by screening tools, they should not be forgotten.

Greenway Considerations

The idea of using the Glover Site as part of an interconnected greenway system has merit. During a period in public health when overweight and obesity is the norm, asthma rates are on the rise, and cardiovascular disease is a leading killer, opportunities for outdoor recreation and physical fitness are critical. Chattanooga Creek is a refreshing scenic view within an industrial core. It seems pleasing to the senses. However, the Chattanooga Creek floodplain witnessed decades of environmental degradation and pollution. Even after some cleanup, there is sufficient evidence that pollution remains. This investigation did not uncover enough evidence to dissuade a greenway. Yet, pollution lingers that will require additional investigation before a greenway can be recommended from an environmental public health perspective.

The frequent flooding of the Chattanooga Creek floodplain should be considered during greenway planning. Hiking trail materials such as mulch or gravel are likely to be washed away when flood waters recede. Therefore, these materials would not make an effective cover over the known PAH contaminated soils. Materials such as asphalt or concrete pavement that will remain in place are better options. A raised boardwalk is an even better option. This option lifts people above the contaminated soils, effectively eliminating exposure pathways. Also, a raised boardwalk would allow flood waters to

flow underneath the decking. The use of handrails or decorative fencing would also be encouraged to keep people from wandering off of the established hiking trails into areas where coal-tar or other pollution may still exist.

Other Chemicals

In addition to PAHs, as previously mentioned, several other chemicals are reported pollutants in the Chattanooga Creek floodplain. Additional environmental samples for pesticide analysis are being prepared as part of UTC's environmental justice grant. It is unknown whether PAHs or other chemicals pose the greater health risk at Glover Site. Whether broken glass is the only problem amongst the old glass dump is unknown. In order to answer these questions, additional characterization of Glover Site is necessary.

Community Concerns

In February 2004, members of the UTC grant partnership met to discuss community concerns. The Glover Site and possible use of the Chattanooga Creek floodplain as a public greenway were the focus of the meeting. The community representatives basically stated that they would not support a greenway without prior cleanup. Some suggested landfill technologies such as liners, caps, and fences prior to greenway construction. Concerns about children having access to a place where pollution levels were high were expressed. The community members were in favor of environmental education and the possibility of an academic research area on the Glover Site. There was also interest in obtaining federal funding to allow for more research and cleanup of Chattanooga Creek.

Children's Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances (ATSDR 1997, 1998). Children have lower body weights than adults. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

In the preparation of this public health document, the health and wellbeing of children was thoughtfully considered. Important health threats unique to children exist along Chattanooga Creek. As PAHs will adhere to soil particles, the hand-to-mouth activity of young children requires special attention. Toddlers, who sometimes display pica behavior (soil-eating), are not expected to wander onto the Glover Site. However, older children and teenagers are likely to explore "the woods" around their neighborhood. In addition to incidental ingestion or inhalation, PAHs adhered to soils can travel on clothes and pets into homes. Physical dangers, including coal-tar deposits, glass, and dumped trash, have been witnessed. Thus, the outdoor activities, of children and teenagers in relation to trespassing (i.e., "playing") on the Glover Site, require special attention.

Conclusions

1. Physical hazards at the Glover Site, Chattanooga, Hamilton, County, Tennessee, pose a public health hazard. Broken glass, sharp objects, and illegally dumped materials could harm children or adults who trespass in the area.
2. No apparent public health hazard exists for people who may come into contact with PAH contamination in soils at the Glover Site.
3. As the Glover Site has not been fully characterized, an indeterminate public health hazard exists from exposure to other contaminants.

Recommendations

1. Additional environmental sampling and data analysis, interpretation, discussions, and education are suggested to characterize the site and to safeguard environmental public health.
2. The environmental danger warning signage around Chattanooga Creek appears to have vanished over time. The agency with environmental regulatory oversight should update signage with plain language messages concerning the pollution that is present in the Chattanooga Creek floodplain.

Public Health Action Plan

1. TDH EEP will provide copies of this health consultation to state, federal, and local government, academia, environmental groups, community groups, and others interested in the greenway project or Chattanooga Creek.
2. TDH EEP will work with environmental agencies to improve the safeguards that prevent people from being exposed to pollution in the Chattanooga Creek floodplain.
3. TDH EEP will be available to review additional environmental data.
4. TDH EEP will maintain dialogue with ATSDR, EPA, TDEC, UTC, TTU, Trust for Public Land, STOP, and other interested stakeholders.

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